SOLAR HEAT REFLECTIVE POOL COVERING

FIELD OF THE INVENTION

This invention relates to pool covers, particularly, swimming pool covers, comprising solar heat reflective materials to reduce the amount of solar energy reaching the water in order to desirably reduce the rise in pool water temperature.

BACKGROUND OF THE INVENTION

Swimming pool solar panels, blankets and the like comprising heat reflective materials are well-known to insulate the pool in order for the water to retain its heat and maintain its temperature.

One such pool cover having integral reflective solar heating and insulative properties is described in United States Patent No. 6,286,155 which issued September 11, 2001 to Handwerker, Gary. USP 6,286,155 describes an improved lightweight, multi-layer, reflective swimming pool cover containing two thermoplastic layers. The top layer has a dark-colored polyethylene film and the lower layer has a polyethylene film with a aluminum concentrate, or other suitable reflecting material, deposited thereon along the entire layer, thereby becoming a reflective surface. The layers are suitably bonded together to form a water and air tight seal so as to provide the cover with a reflective surface on which are integral reflective solar heating and insulative pockets configured in a predetermined spatial relationship to each other. The cover acts to continually reflect radiating heat back into the pool and provides an effective and enhanced insulation barrier against radiant heat loss from the pool.

The pool cover described in USP 6,286,155 and other prior art references are all concerned with, in effect, insulating the pool to maintain the water temperature by reducing the radiant heat loss from the pool.

However, there are situations in certain geographical locations where it is not only highly desirable to eliminate the use of heat-retaining insulation, but to actually take steps, such as by the use of ice, refrigeration means and the like to cool the pool water to a desired temperature for swimmers and other users of the pool.

However, such cooling means may constitution a significant expense in capital equipment and operating costs, and as well as an inconvenience to the pool owner.

There is, therefor, a need for an improved method of ameliorating the unwanted effect of solar heating of pools, particularly, swimming pools.

Insulation materials are also known which comprise a clean, non-toxic, heat barrier made of aluminum foil bonded to a single or double layer of polyethylene-formed bubbles spaced one bubble from another bubble in the so-called "bubble-pack" arrangement. Non-foil bubble-packs are used extensively as packaging material, whereas the metal foil bubble-pack sheet is used as thermal insulation in wood frame structures, walls, attics, crawl spaces, basements and the like and as wrapping for hot water heaters, hot and cold water pipes, air ducts and the like. The reflective surface of the metal, particularly, aluminum foil enhances the thermal insulation of the air-containing bubble-pack.

Generally, low density polyethylene films of 1 – 12 mil, optionally, with various amounts of linear low density polyethylene in admixture when additional strength is required, are used for the above applications. The insulating properties of the bubble pack primarily arise from the air in the voids. Typically, bubble diameters of 1.25 cm, 0.60 cm and 0.45 cm are selected.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a multilayer pool cover having reflective solar heat properties to provide an effective barrier to the ingress of solar radiation through the cover to the water in the pool.

It is a further object of the invention to provide in combination a swimming pool containing water and a multilayer pool cover having reflective solar heat properties to provide an effective barrier to the ingress of solar radiation through the cover to the water in the pool.

It is a further object of the invention to provide a method of ameliorating undesired heating of a swimming pool by solar radiation by covering the pool with a multilayer pool cover having reflective solar heat properties to provide an effective barrier to the ingress of solar radiation through the cover to the water in the pool.

Accordingly, in one aspect the invention provides a multilayer cover for a pool containing water comprising

(a) an uppermost layer comprising a solar heat reflective material; and

(b) a lower layer comprising a first thermoplastic film

(i) having a plurality of portions wherein each of said portions defines a cavity; and

(ii) in sealing engagement with said uppermost layer to provide a plurality of closed said cavities; wherein said uppermost layer provides an effective reflective barrier to the ingress of solar radiation through the cover to the water in the pool.

The reflective pool covers according to the invention as hereinabove defined provides for the efficacious reflection of solar radiation by reason that the reflective surface is uppermost of the cover when located on the pool. The so-called "bubble pack" construction effect of the cover, preferably, allows the cover to float on the water, if desired. This obviates the need for structural supports, spars and the like above the water surface.

Surprisingly, we have found that, notwithstanding the intense solar radiation present, for example, in the American South-Western states, during the summer months, the degree of reflectance, generally 95-97%, by the cover according to the invention is still sufficient to meet the objects of the present invention.

An essential and distinguishing feature of the covers according to the invention is that the solar radiation reflective surface of the uppermost layer faces the solar radiation.

The uppermost layer (a) of the cover hereinabove defined, in a preferred aspect, may be constituted as a thin metal foil, preferably, aluminum, which is bonded in sealing engagement to the lower layer of a plastics material (b) to provide an integral "bubble pack" arrangement, which assists the cover to float on water.

The uppermost layer (a) in an alternative embodiment may be constituted as a metallized reflective surface thermoplastic film, well-known in the art, which film is bonded in sealing engagement with the aforesaid lower layer (b) to provide the "bubble-pack" configuration.

The lower layer (b) is preferably formed of a thermoplastic material selected from the group consisting of low density polyethylene, linear low density polyethylene, polypropylene, a nylon and PVC.

Although the uppermost layer comprising the reflective material (a) to the invention as hereinabove defined, is, indeed, the uppermost member of the cover, it is to be understood

that the reflective material may have a protective film, coating or the like of a second thermoplastic material on the top surface of the reflective material, to protect against or reduce corrosion, delamination or other destructive effects caused by the chemical-containing pool-water. Preferably, the protective coating has a thickness of less than about 0.5 mm and does not substantially affect the desired reflective property of the uppermost reflective layer.

It will be understood that a pool cover may comprise in whole or in part a cover as hereinabove defined.

In a further aspect, the invention provides a covered pool assembly comprising in combination a pool containing water and a multilayer cover for the pool disposed on or above the water, said cover being a multilayer cover comprising

(a) an uppermost layer comprising a solar heat reflective material; and

(b) a lower layer comprising a first thermoplastic film

(i) having a plurality of portions wherein each of said portions defines a cavity; and

(ii) in sealing engagement with said uppermost layer to provide a plurality of closed said cavities wherein said uppermost layer provides an effective reflective barrier to the ingress of solar radiation through the cover to the water in the pool.

In preferred embodiments, the combination comprises a pool cover according to the invention as hereinabove defined.

In a further aspect, the invention provides a method of a method of preventing or reducing the rate of increase in water temperature in a pool containing water by solar-radiation, said method comprising covering said pool, in whole or in part, with a multilayer cover for a pool containing water comprising

(a) an uppermost layer comprising a solar heat reflective material; and

(b) a lower layer comprising a first thermoplastic film

(i) having a plurality of portions wherein each of said portions defines a cavity; and

(ii) in sealing engagement with said uppermost layer to provide a plurality of closed said cavities; wherein said uppermost layer provides an effective reflective barrier to the ingress of solar radiation through the cover to the water in the pool.

In preferred embodiments, the method comprises covering the pool with a cover as hereinabove defined.

The covers according to the invention as hereinabove defined may be made using lamination, sealing, bonding and metallization techniques well-known in the art, as desired.

The covers of the present invention, as hereinabove defined, may further comprise one or more layers of thermoplastic materials which may or may not be in the form of an additional "bubble pack" arrangement.

BRIEF DESCRIPTION OF THE DRAWINGS

In order that the invention may be better understood, preferred embodiments will now be described, by way of example only, wherein:-

FIGS. 1-3 represent diagrammatic cross-section views of embodiments of reflective solar covers according to the invention;

FIG. 4 represents a diagrammatic cross-section of a swimming pool assembly according to the invention; and wherein the same numerals denote like parts.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

With reference to Fig. 1, this shows generally as 10 a "bubble-pack" cover for a swimming pool having an uppermost layer or top 12 of aluminum sheet foil having an external aluminum surface, a lower layer 14 consisting of 5 mil polyethylene film 15 and an intervening 5 mil polyethylene film 16 between foil 12 and film 15 and bonded thereto in sealing engagement. Film 16 has a plurality of portions 18, each of which defines a cavity 20, and which with foil 12 define a plurality of closed cavities 20.

Fig. 2 shows generally as 100 a bubble-pack cover having a lower layer 102 consisting of polyethylene film 15 and film 16 as shown in Fig. 1 except that top 12 shown therein has been substituted with a metallized film 104 of a polyethylene film 106 impregnated/coated with, in this embodiment, aluminum of a few hundred angstroms thickness 108.

Fig. 3 shows generally as 200 the embodiment of Fig. 1 wherein uppermost layer of aluminum foil 12 has a coating of a protective polyethylene film 202 of 0.25 mm thickness.

Fig. 4 shows generally as 300 a swimming pool assembly according to the invention comprising a pool of water 302 having a cover 10 as described with reference to Fig. 1, with the solar radiation reflective surface of aluminum foil 12 from sun 306 uppermost to reflex rays 304.

EXAMPLE 1

A comparison test was carried out on two solar blanket pool cover's ability to maintain water temperature. Sample A was a black coloured bubbled sheet with a light transparent blue backing solar blanket. Sample B was a transparent blue coloured bubbled sheet with a silver backing solar blanket. Temperatures of the water were recorded using a Honeywell Multipoint Recorder with Type T thermocouples.

The objective of the silver insulated cover was to reduce the heat gain of the pool under sunny conditions (cool). The objective of the dark cover is to keep the heat in the pool (warm).

TEST METHOD

Insulated tanks measuring 377 mm wide by 565 mm long by 315 mm high were set up under a bank of heat lamps away from obstructions, which could cast a shadow on one or both the tanks. The tanks were filled to a level of 254 mm deep with tap water. Thermocouples to measure water temperature were placed in the tanks 125 mm from the bottom of the tank. The covers were cut to 330 mm wide by 515 mm long to fit the opening in each tank. Thermocouples were placed between the two tanks to measure the air temperature. The temperatures were recorded on the chart recorder for the test period, and readings were taken from the chart paper at 4 hour intervals for comparison.

RESULTS

TABLE I

Time	Temperature				
(hours)	Sample A		Sample B		Air Temperature
	Measured (°C)	Deviation from air (C°)	Measured (°C)	Deviation from air (C°)	Measured (°C)
0	127	19	102	-6	108
4	127	21	103	-4	107
8	130	25	104	-1	105
12	131	28	103	0	103
16	132	29	103	0	103
20	133	24	104	-6	109
24	134	28	104	-3	107
28	135	29	104	-2	106
32	135	30	104	-2	106
36	135	29	103	-3	106
40	135	28	103	-4	107
44	135	28	104	-3	107
48	135	29	103	-3	106
Average	133	27	103	-3	106

COMMENTS

The results in Table I show that Sample B maintained a water temperature cooler in the tank than the Sample A solar blanket. The Sample B blanket would serve to keep the water in a pool cooler under hot sunny conditions.

EXAMPLE 2

A comparison test was carried out on two solar blanket pool covers' ability to maintain water temperature. The samples were designated Type 1, a reflective silver foil backing cover with air bubbles laid metalized side upwards facing the thermal radiation on the water surfaces, and Type 2, a prior art transparent backing cover with air bubbles, with the blue backing also facing upwards. Temperatures were recorded using a Sciemetric Instruments System 200 data acquisition with type T thermocouples. A clear polyethylene sheet was used as a control.

The objective of the experiment was to determine the effect as to whether any of the insulated covers reduce the heat gain of the pool under sunny conditions.

MATERIALS

Type 1 - Silver reflective bubbled sheet backing solar blanket.

Type 2 - Transparent blue coloured bubbled sheet backing solar blanket.

Control - Clear sheet of 0.009 inches thick polyethylene plastic.

TEST METHOD

Insulated tanks measuring 13.5 inches wide by 22 inches mm long by 13 inches high were set up under a bank of heat lamps 15 inches apart, and 17 inches above the water surface. The heat lamps were set-up away from obstructions, which could cast a shadow on the tanks. The tanks were filled with tap water to a level of 10.5 inches deep. Thermocouples to measure water temperature were placed in the centre of the tanks and 3 inches from the bottom of the tank. The covers were cut to 11.375 inches wide by 19.125 inches long to fit the opening in each tank. Thermocouples were placed 4 inches above each tank and 2.5 inches from each side of the centerlines of the tank to measure the air temperature above the covered surface. The temperatures were recorded in a computer connected to the data acquisition system in 10 minute intervals for the test period of 75 hours. Readings were extracted from the data file at 3 hour intervals for comparison.

RESULTS

TABLE II

Time	Temperature (°F)						
(hours)	Type 1 Reflective Silver		Type 2 Clear Blue		Control Clear Plastic		Air Temperature
	Water	Air	Water	Air	Water	Air	Laboratory
0	63.9	66.6	63.9	65.5	64.6	66.2	63.5
3	66.9	82.4	66.2	90.7	68.7	88.0	62.8
6	67.5	85.1	68.5	93.0	72.5	88.7	62.4
9	68.5	86.4	71.8	94.8	77.2	89.6	66.2
12	69.8	87.3	76.1	95.4	82.6	92.1	66.2
15	71.4	85.6	81.1	95.9	88.5	90.3	65.8
18	72.7	86.9	86.2	94.3	93.9	91.2	65.5
21	73.9	86.7	91.2	94.1	99.1	90.5	65.1
24	75.2	89.8	96.1	97.9	104.0	93.0	68.2
27	76.5	90.5	101.1	96.8	108.9	94.8	68.2
30	78.1	88.2	105.4	95.7	113.2	92.7	67.1
33	79.3	89.6	109.6	97.2	117.3	92.7	67.3
36	80.4	91.0	113.4	100.2	120.9	95.4	68.2
39	81.5	91.4	116.8	98.6	124.3	94.6	68.4
42	82.6	90.3	120.4	100.4	127.6	91.4	68.0
45	83.5	91.8	123.3	97.3	130.3	95.5	67.8
48	84.4	91.0	126.1	100.0	133.0	94.1	68.5
51	85.3	88.5	128.3	96.1	135.1	91.2	66.6
54	86.0	89.6	130.5	98.8	137.1	95.5	68.0
57	86.7	89.4	132.8	98.1	138.2	91.6	67.5
60	87.3	91.4	134.6	99.5	140.7	95.5	68.7
63	88.0	90.9	136.6	98.8	142.3	93.6	68.2
66	88.5	89.6	138.2	99.0	144.0	95.7	68.0
69	89.1	91.2	139.6	100.2	145.2	95.2	68.0
72	89.6	92.1	140.9	100.9	146.7	96.6	68.9
75	90.1	87.6	142.0	96.4	147.7	93.2	67.1

COMMENTS

The results given in Table II show that the Type 1 solar blanket maintained a water temperature cooler in the tank than either of the Type 2 solar blanket and control plastics sheet. Accordingly, the Type 1 blanket would serve to keep the water in a pool cooler under hot sunny conditions than the other materials.

Although this disclosure has described and illustrated certain preferred embodiments of the invention, it is to be understood that the invention is not restricted to those particular embodiments. Rather, the invention includes all embodiments which are functional or mechanical equivalence of the specific embodiments and features that have been described and illustrated.